The 1st R-CCS

International Symposium

K and Post-K: Simulation, Big Data and AI supporting Society 5.0

VALIDATION OF ALTERNATIVE TECHNOLOGY BY DIRECT TURBULENCE SIMULATION FOR TOWING TANK EXPERIMENT

Dr. Tatsuo Nishikawa,

Shipbuilding Research Centre of Japan,

February 17, 2019, Kobe International Conference Center

TOWING TANK TEST



FRAMEWORK

| - 2011 Development - K and Post-K Project Priority Issue 8 | | | | |
|--|-------------------------|---|--|--|
| | | | | |
| University of Tokyo | Mizuho Informat | Mizuho Information and Research Institute | | |
| Prof. C. Kato | Mr. Yamamde | Mr. Yamamde | | |
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| Shipbuilding Research Centre Dr. Nishikawa | | | | |
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| imapan shippoliaing | | Oshima shippolialng | | |
| Ship Kurushima Dockyard | Sanovaru Shinbuildi | Ing Naikai Zasan | | |
| Shin Kurushin du Duckyuru | | | | |
| Namura Shinbuildina | Tshupoishi Shiphuilding | 8 maior domestic | | |
| Namora Shippoliaing | TSHUMEISHI SHIPDUIQING | shipyards | | |
| — 2013 Validation — | K Industrial Use — | | | |

K AND POST-K PROJECT PRIORITY ISSUE 8

Development 2011-2018

COMPUTATIONAL METHOD

- FrontFlow/blue (FFB)
 - Incompressible, LES, finite element method, fractional step, BCGStab
 - Dynamic overset, VOF, ALE, 6DOF, etc.
- Large-scale industrial LES
 - Grid generation
 - Refine in the solver
 - CAD data is referred
 - Massively-parallel computation
 - Use double and single precision as the situation demands
 - Low Byte/Flops algorithm using bit operation (low memory transfer)



MODEL(KVLCC2)







Initial mesh(67 million cells for hull, 20 million cells for propeller)



VORTEX DISTRIBUTION AT THE MIDSHIP





TOTAL RESISTANCE 2013





WAVE-MAKING RESISTANCE





SELF-PROLUSION





船舶設計の効率化に向け、 数年後の実用化を目指す 利用者アンケート結果のご紹介

利用支援のご案内

2.就水槽試験中の400m水槽 国立研究開発法人 海上・港湾・航空技術研究所



K INDUSTRIAL USE

Validation 2013-2018



CFD WORKSHOP 2015 K Industrial Use



JAPAN BULK CARRIER (JBC)





Energy Saving Device

Pressure Distributions and Limiting Streamlines

PRACTICAL USE

- Commercial viability.
 - SRC has a long history of commercial towing tank test.
 - Possible to use same business framework.
 - Third party standpoint
- Market research to domestic shipyards.
 - Reality is not so simple
 - Surprise and compliment at first
 - Shortage of money (as usual)
 - Changing their mind
 - CFD is not cheaper than experiment anymore
- Validation data is not enough yet
 - Ballast loading condition
 - Energy saving device
 - Continue to increase more experience

POST K

- Wall-resolved LES in higher Reynolds number.
 - Impossible for actual ship scale simulation.
 - Possible to extrapolate performance better than now.
 - Wall-modeled LES becomes in the scope.
- Maneuverability performance.
- Resistance increase in wave condition.
 - Necessary long period of simulation
 - Feasible only by Post K
- Surface roughness in actual use.
 - Manufacturing limitation/error
 - Biofouling